State of Louisiana
Coastal Protection and Restoration Authority

2019 Short Summary Report

for

East Sabine Lake Hydrologic Restoration (CS-32)

State Project Number CS-32
Priority Project List 10

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Cameron Parish

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2019 Operations, Maintenance, and Monitoring Report
For
East Sabine Lake Hydrologic Restoration (CS-32)

Table of Contents

I. Preface

The East Sabine Lake Hydrologic Restoration Project (CS-32) 2019 short summary report includes monitoring data collected through December 2018.

This report is intended to update USFWS and NRCS on the latest land change and CRMS supplemental data. For more detailed analyses, see the previous comprehensive OM&M reports (2012 and 2015) online at http://lacoast.gov/new/Projects/Info.aspx?num=CS-32. Future summary reports are planned for 2021 and 2024 and a comprehensive OM&M report is planned for 2028.

II. Monitoring Activity

The CWPPRA projects authorized for construction after August 14, 2003 are monitored with Coastwide Reference Monitoring System - *Wetlands* (CRMS) stations, other existing data collection, and any additional data collection specifically added to the project and funded separately from the standard CRMS monitoring. One CRMS site (CRMS0660) is located within the Greens Lake terrace area.

a. Monitoring Goals

The East Sabine Lake (CS-32) project is classified as a marsh restoration, hydrologic restoration, and shoreline protection project. Land area is expected to increase with the addition of terraces north and south of Greens Lake. Through the use of passive water control structures and terraces, a more beneficial hydrology is expected in the vicinity of Pines Ridge and Greens Lake. In the Pines Ridge area, the low-level weir is expected to attenuate rapid water fluctuations and salt water intrusion from Sabine Lake caused by artificial channel connections (Gray's Canal or Pines Ridge Canal) that increased hydrologic exchange. The rock dike along Sabine Lake is expected to stop erosion.

The specific measurable goals established to evaluate the effectiveness of the project are:
1. Evaluate land area changes in the project area, especially the terraced areas around Greens Lake.
2. Evaluate water level variability within Pines Ridge and Greens Lake area.
3. Evaluate water salinity within Pines Ridge area and Greens Lake.
4. Evaluate shoreline change along Sabine Lake behind the gapped, foreshore, rock dike.

Goals 1-3 will be assessed in this report.

b. Monitoring Elements

The following monitoring elements will provide the information necessary to evaluate the specific goals listed above:

Land Change

To evaluate land area changes in the project area, land/water ratios were estimated for each project area (Greens Lake terraces, foreshore dike along Sabine Lake, and water control structures at Pines Ridge, Double Island Gully, and Bridge Bayou) from available aerial photography minimum of 1 m^2 resolution collected in years 2008 and 2015. The photography was processed by National Wetlands and Aquatic Research Center (NWRC) personnel using standard operating procedures through GIS analysis (Steyer et al. 1995, revised 2000). In addition, land change of the project area as a whole will be assessed from land/water data interpreted from TM satellite imagery (30 m^2 resolution) which is stored on the CRMS Viewer website (http://www.lacoast.gov/crms_viewer/); pre and post construction comparisons will be made, and inferences will be drawn from project area (CS-32) and basin (Calcasieu/Sabine) comparisons.

<u>**CRMS Supplemental**</u>

Additional data are collected at CRMS-*Wetlands* stations which can be used as supporting or contextual information for this project. In addition to project/reference comparisons within the vicinity of project, comparisons to CRMS sites at hydrologic basin and marsh type scales coastwide can also be made. Spatial and hydrologic (surface and porewater) data representing the 1 km^2 area encompassing the CRMS stations were used in this report (Folse et al. 2018).

    c.   **Monitoring Results and Discussion**

i.   **<u>Land Change</u>**

Land change trends prior to construction show that the CS-32 project area was slowly gaining land at a rate of 8 acres/year from 1984-2005 (Figure 1). The construction of 127 acres of terraces around Greens Lake resulted in small land gains for CS-32 through 2009 despite hurricanes Katrina in 2005 and Gustav in 2008. Land gain trends after 2009 seem to fall out of the 95% confidence interval and do not coincide with other land to water rates, thus will not be used. The project has fared better than the CalSab basin as a whole, which showed a net loss during the same time frame.

Land area of the five CS-32 project areas was assessed from 1:12,000 scale aerial photography in 2008 (Figure 2), while the 2015 data were obtained from 1 m resolution color infrared digital orthoimagery (Figure 3). Aerial photography from 2008 to 2015 shows that area 1 and area 4 have lost 3 and 1 percent land respectively while the other areas have gained or remained stable. Overall the percent land area has remained stable with very little change in percent land from 2008 to 2015 (Table 1).
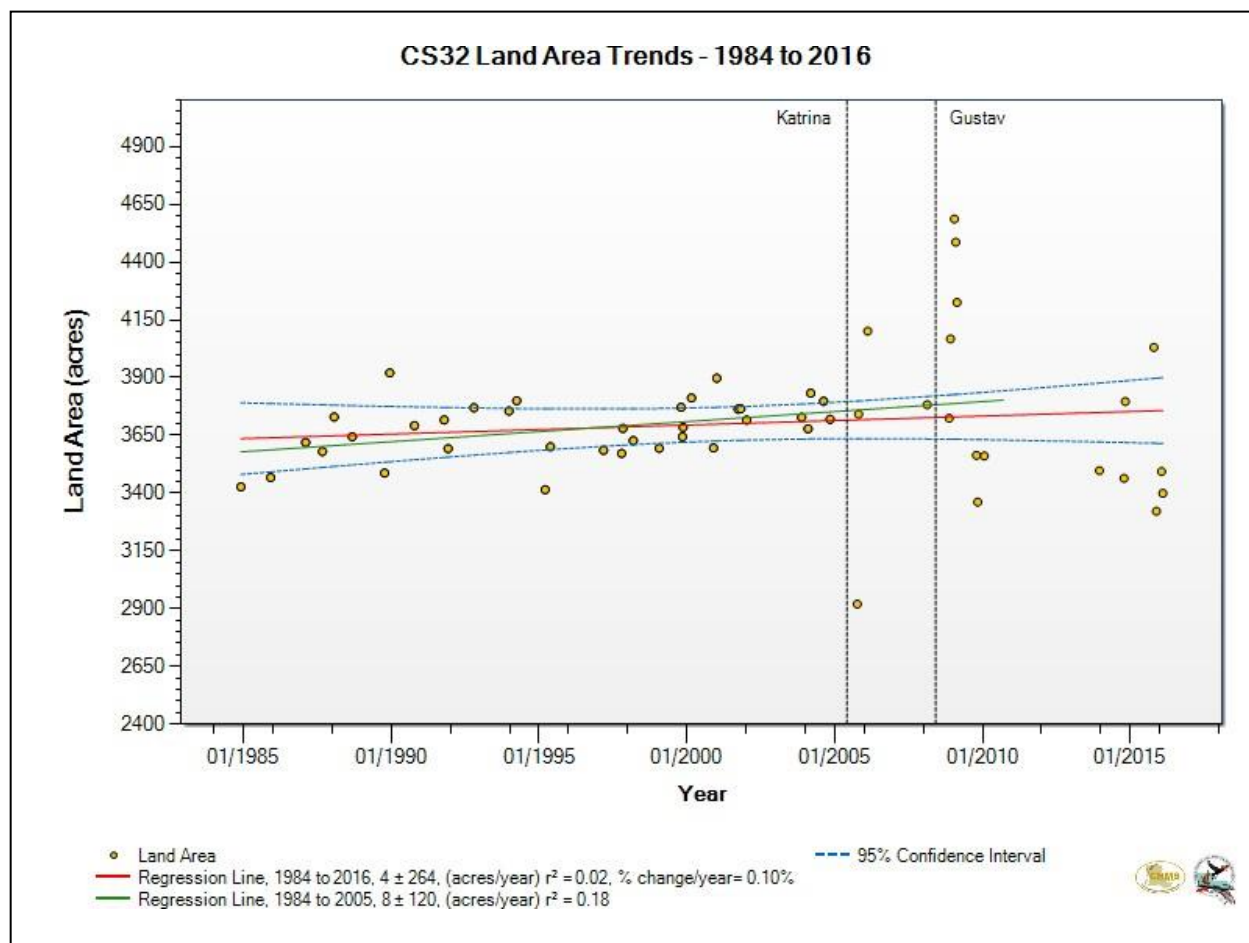
Figure 1. Project scale percent land change for CS-32. Percent land values are displayed for all cloud free TM images available from 1985-2016. The green and red lines depict the pre- and post-construction percent land trends, respectively. Percent land calculated as percent land of total project area. See Couvillion et al. 2017.
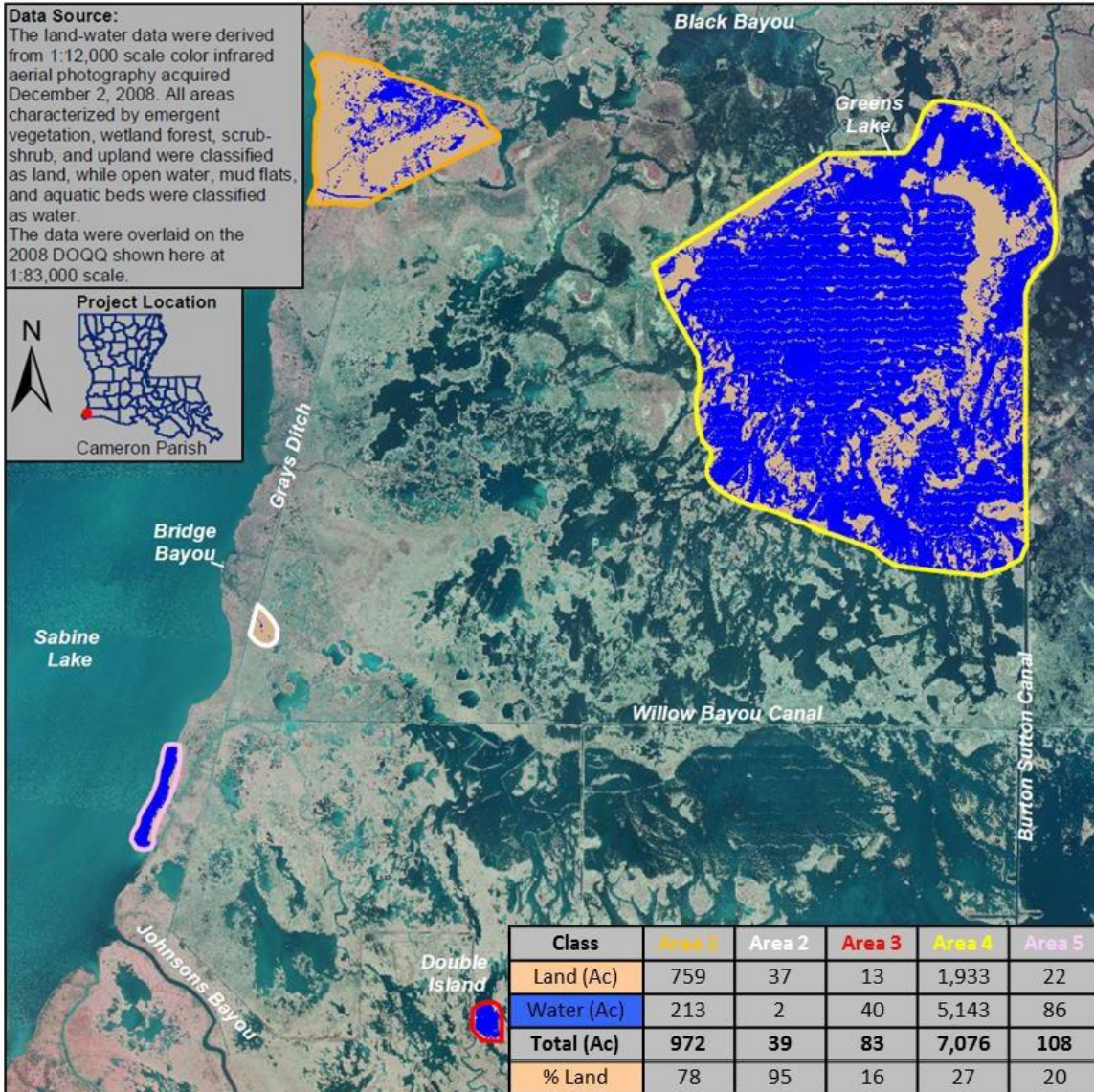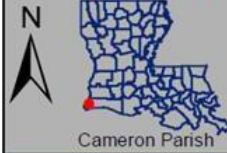
Table 1. Percent Land Change comparison of the CS-32 project areas (Area 1 – Pines Ridge, Area 2–Bridge Bayou at Grays Ditch, Area 3 – Double Island Gully, Area 4 – Greens Lake Terraces, Area 5 – Sabine Lake Rock Dike at Willow Bayou) from 2008 and 2015.

Year	Class	Area 1	Area 2	Area 3	Area 4	Area 5
2008	Land (%)	78	95	16	27	20
2015	Land (%)	75	97	25	26	20

Figure 2. Land and water classification of the CS-32 project areas (Area 1 – Pines Ridge, Area 2 – Bridge Bayou at Grays Ditch, Area 3 – Double Island Gully, Area 4 – Greens Lake Terraces, Area 5 – Sabine Lake Rock Dike at Willow Bayou) from 2008 (post construction Year 1).

5

Figure 3. Land and water classification of the CS-32 project area (Area 1 – Pines Ridge, Area 2 – Bridge Bayou at Grays Ditch, Area 3 – Double Island Gully, Area 4 – Greens Lake Terraces, Area 5 - Sabine lake Rock Dike at Willow Bayou) from 2015.
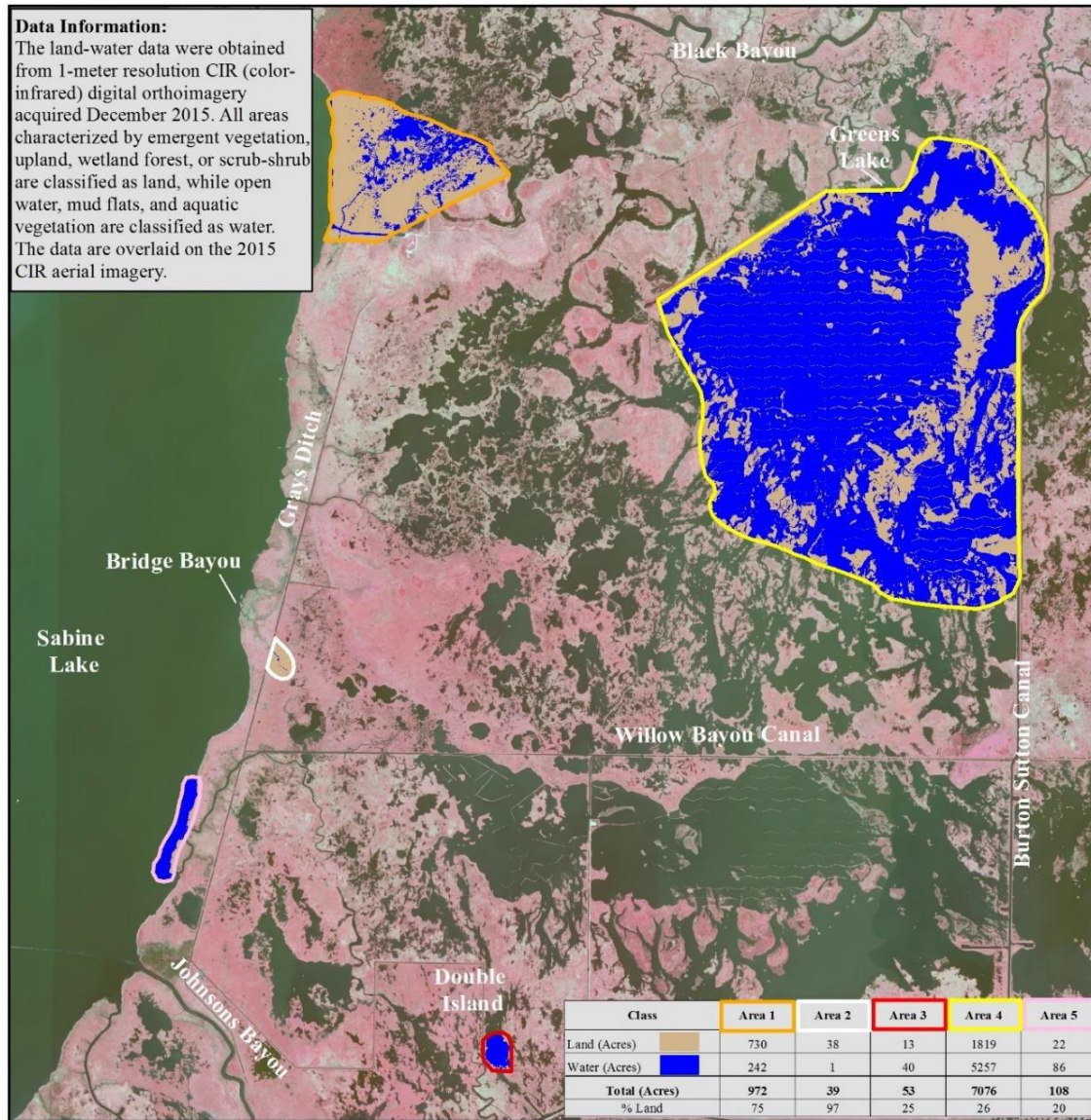
ii.   CRMS Supplemental

The Coastwide Reference Monitoring System – Wetlands (CRMS) is a large repository of monitoring information at the CRMS site and CWPPRA project levels covering a variety of spatial scales. The following data and graphics are all available through the CRMS website (http://lacoast.gov/crms_viewer/).

iii.   Spatial

Land/Water classifications of 2005, 2008, 2012 and 2015 aerial photography were performed on the 1 km^2 area encompassing CRMS0660 by the USGS-National Wetlands Research Center (Figure 4). Hurricane Ike had a marked effect on the site; approximately 10 acres of marsh was displaced by the storm surge and either removed from the area, deposited elsewhere on previously existing marsh, or deposited in the open water. By 2012, most of the loss was recovered within the 1 km^2 and was stabilized through 2015.

CRMS Site 0660
Coastwide Reference Monitoring System (CRMS)
2005, 2008, 2012, and 2015 Land/Water Classifications and Matrix

2005 Land/Water Classification

2008 Land/Water Classification

2012 Land/Water Classification

2015 Land/Water Classification

2005/2008/2012/2015 Land/Water Classification Matrix

Background:
The analysis presented here is part of a program which monitors land area change using fine-spatial scale aerial imagery approximately every three years at Coastwide Reference Monitoring System (CRMS) sites. This site is one of 390 sites that encompass the range of ecological conditions in coastal Louisiana.

Data Information:
Refer to individual data products for information regarding each year of data. All areas characterized by emergent vegetation, upland, wetland forest, or scrub-shrub were classified as land, while open water, aquatic beds, and mudflats were classified as water.

Land/Water Classification Legend (Individual Years)

Land

Water

Data Collection Area (DCA)*

*Field collection of ecologic and hydrologic parameters occur within the DCA.

CRMS 0660			
	Land (Acres)	Water (Acres)	Total (Acres)
2005	130.8	116.3	247.1
2008	120.1	127.0	247.1
2012	128.8	118.3	247.1
2015	127.2	119.9	247.1

Matrix Information:
The matrix is provided for coarse scale observations. Errors in georectification can contribute to fine-scale differences among years. Please refer to product metadata for more information on appropriate uses for the data and its interpretation.

CRMS 0660			
Color	Class Description	% of Area	Acres
	Dirt	0.10%	0.25
	Persistent land	43.79%	108.20
	Ephemeral water-2008	2.25%	5.57
	Ephemeral water-2012	0.23%	0.58
	Land-water-water-land	0.60%	1.49
	Land-water-land-water	0.67%	1.65
	New water-2015	0.43%	1.06
	Persistent loss-2012	0.47%	1.17
	Persistent loss-2008	4.47%	11.04
	Persistent gain-2008	1.86%	4.60
	Persistent gain-2012	1.63%	4.04
	New land-2015	0.95%	2.35
	Water-land-water-land	0.13%	0.31
	Water-land-land-water	0.51%	1.26
	Ephemeral land-2012	0.92%	2.28
	Ephemeral land-2008	1.13%	2.79
	Persistent water	39.86%	98.45
	Total	100.00%	247.11

Project Location

Prepared by:
U.S. Department of the Interior
U.S. Geological Survey
Wetland and Aquatic Research Center
Baton Rouge, Louisiana
Prepared for:
Louisiana Coastal Protection and
Restoration Authority
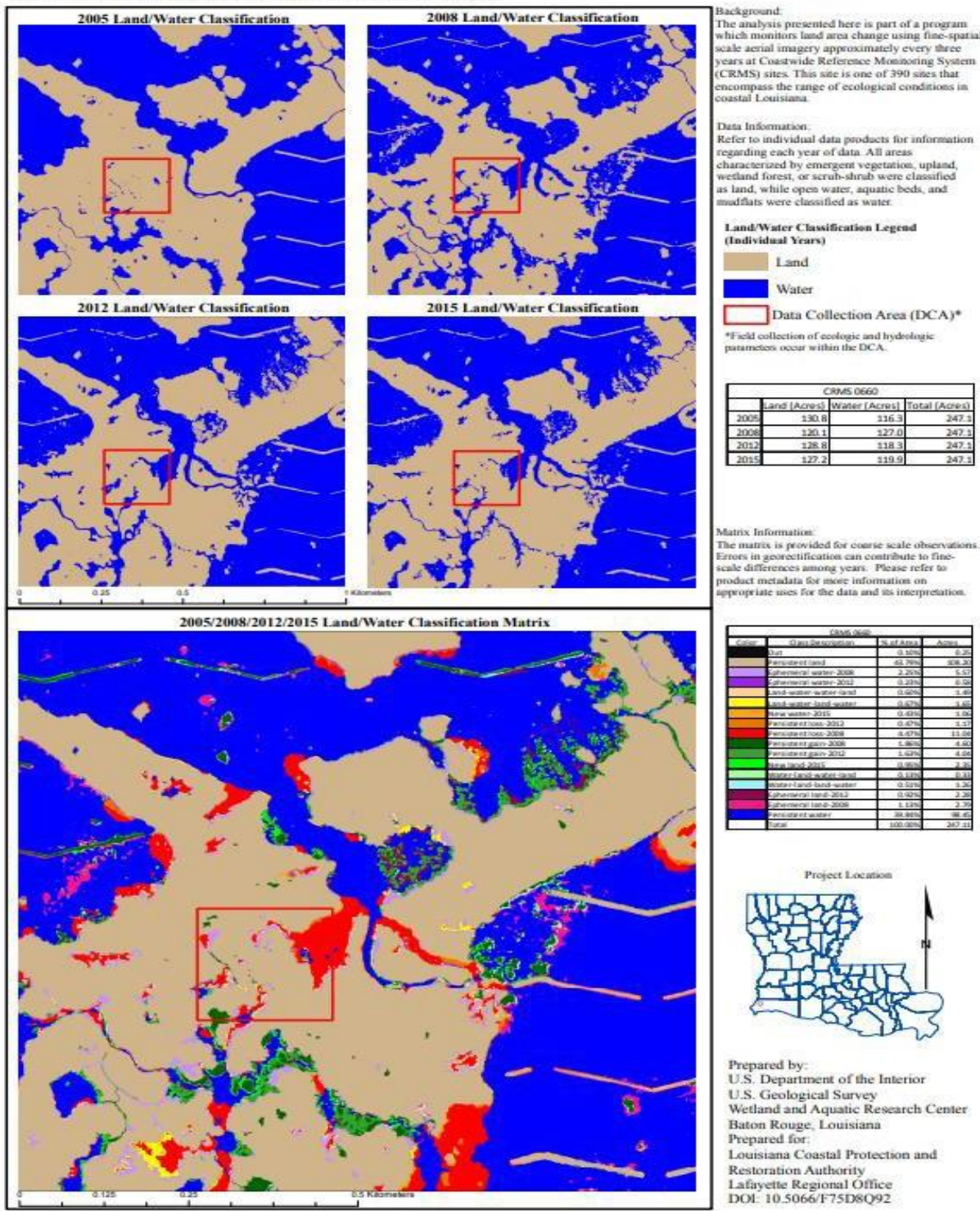Lafayette Regional Office
DOI: 10.5066/F75D8Q92

Figure 4. Land/Water classification for project site CRMS0660 for 2005, 2008, 2012 and 2015.

8

iv.   **Hydrology**

Hydrologic data has been collected on an hourly basis at CRMS0660 in the CS-32 project area since 2006 (Figure 5). During this time, the hydrology of the area in western Calcasieu/Sabine hydrologic basin (CS basin) has been largely affected by climatological events. After settling into seasonal water level patterns and lower salinities following Hurricane Rita in 2005, Hurricane Ike ushered in another large storm surge with the associated inundation of salty water in September 2008. After salinities returned to pre Hurricane Ike concentrations (< 5 ppt), aided by a large rain event in September 2009 that increased water levels while decreasing salinity, a drought lasting over 1.5 years lowered water levels and increased salinities to beyond 20 ppt during the summer of 2011. The drought ended in 2012 with the return of average to above average annual rainfall, enabling surface and porewater salinities to return to normal. Water levels were elevated in the project area in 2016 , resulting in frequent flooding, particularly in September and October of 2017 with the historical rainfall of Hurricane Harvey. This trend of persistent flooding has been noted in the CS basin as a whole. Marshes are flood stressed leaving them vulnerable to land loss from future disturbances. See the 2019 CS Basin Summary Report for more detailed information and analyses on trends within the basin.
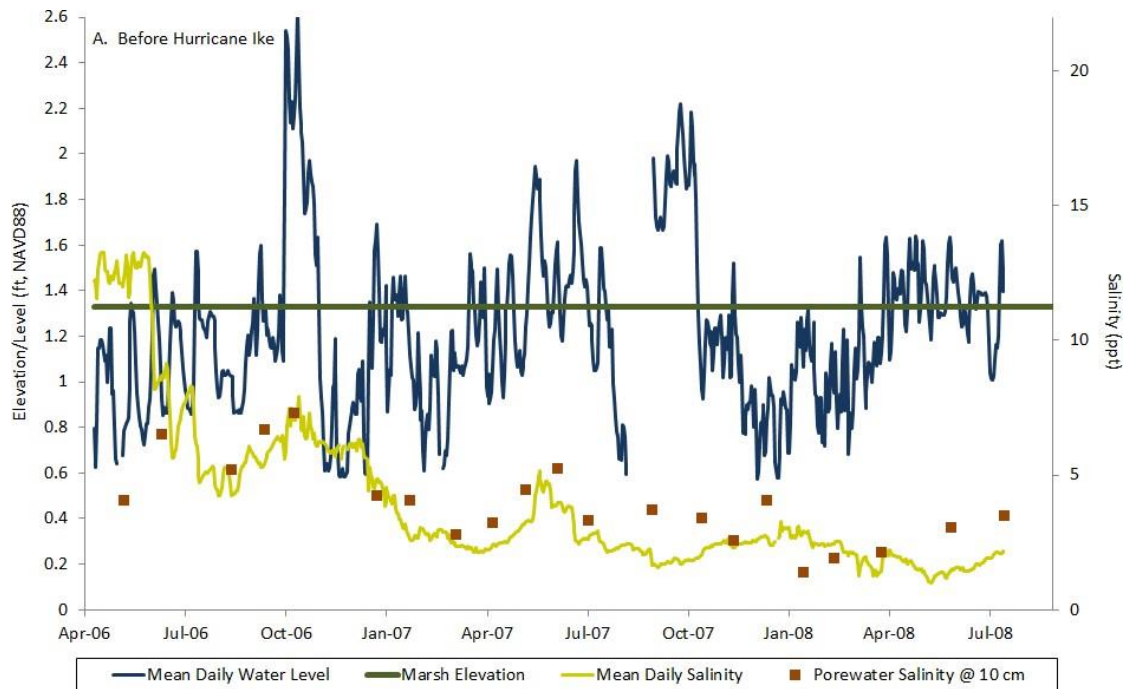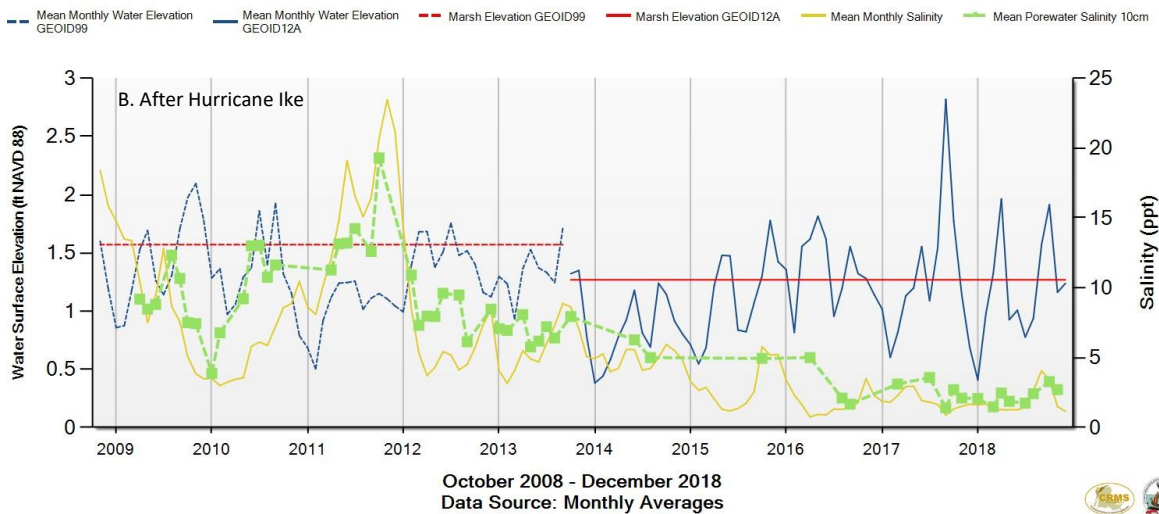
Figure 5. Hydrologic data (surface water level and salinity) and porewater salinity was collected from the CS-32 terrace area (CRMS0660) from April 26, 2006 through December 31, 2018. Note that marsh elevation was adjusted when the marsh sampling stations were re-established following Hurricane Ike and were again shifted following an updated survey in 2014 using Geoid12a.

III.   Conclusions

a.   Project Effectiveness

Overall land loss has slightly increased in the project area between 2008 and 2015. Although areas 1 and 4 had minimal land loss, areas 2 and 3 had land gains (Table 1). Flooding was more prevalent in 2016 and 2017 but overall mean yearly water levels remained at or below marsh elevation in other years (Figure 5). High water has enabled salinity levels to return to pre-Hurricane Ike levels but also creates stress to the marsh vegetation, leaving it vulnerable to land loss. The CS-32 project is progressing towards meeting most project goals.

IV. Literature Cited

Couvillion, B.R., Beck, Holly, Schoolmaster, Donald, and Fischer, Michelle, 2017, Land area change in coastal Louisiana 1932 to 2016: U.S. Geological Survey Scientific Investigations Map 3381, 16 p. pamphlet, https://doi.org/10.3133/sim3381.

Folse, T. M., L. A. Sharp, J. L. West, M. K. Hymel, J. P. Troutman, T. McGinnis, D. Weifenbach, W. M. Boshart, L. B. Rodrigue, D. C. Richardi, W. B. Wood, and C. M. Miller. 2018. A Standard Operating Procedures Manual for the Coast-wide Reference Monitoring System-Wetlands: Methods for Site Establishment, Data Collection, and Quality Assurance/Quality Control. Louisiana Coastal Protection and Restoration Authority, Office of Coastal Protection and Restoration. Baton Rouge, LA. 228 pp.

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